Preliminary Estimates of Protected Species Bycatch Rates in the U.S. Atlantic Pelagic Longline Fishery Between 1 January and 31 March 2007

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May 2007
PRD Contribution: #PRBD-06/07-04:13 p.

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Background

The U.S. Atlantic Pelagic Longline fleet operates throughout the Northwestern Atlantic Ocean including along the U.S. coast from the Gulf of Mexico to New England, the waters of the Caribbean, and in international waters of the North Atlantic Ocean. The longline fishery has had a documented history of incidental takes of non-target species including marine turtles and marine mammals. During recent years there were elevated takes of leatherback turtles in the Gulf of Mexico (Garrison, 2003). As a result, a Biological Opinion on the pelagic longline fishery was developed by NOAA Fisheries under the Endangered Species Act, which requires several actions to be taken to improve monitoring and reduce interactions with leatherback and loggerhead turtles. These regulations reopened the Northeast Distant (NED) fishing area, with restrictions, on 30 June 2004, and similar restrictions were imposed on the rest of the fleet effective 5 August 2004. These regulations eliminate J-hooks from the fishery and mandate that all pelagic longline gear use circle hooks $\geq$ 16/0, and only hooks $\geq$ 18/0 may be used in the NED area. The regulations further require that hooks < 18/0 have no offset, while hooks $\geq$18/0 may have an offset $\leq$10 degrees.

The Biological Opinion requires quarterly reporting of interactions with protected species including marine mammals and marine turtles. The goal of this measure is to more closely monitor any potential short-term increases in interaction rates and thereby allow a more responsive management program. This report meets this requirement and includes the observed fishery effort and incidental takes reported by the pelagic longline observer program (POP) including sets from 1 January 2007 to 31 March 2007.

While it would be desirable to have directly estimated the absolute level of takes (i.e. the total number of turtlesor mammals estimated to be taken by the fishery), fishery effort data are reported on logbook forms by fishing captains, and current data are therefore not available until several months after the end of any given quarter. As a result, the bycatch rate (i.e. catch per unit effort) presented was based solely on observer data as an indicator of the relative level of interactions with protected species. The observed bycatch rate by fishing area during quarter 1 of 2007 was compared to that observed in quarter 1 of 2006 and to the average of the previous five years (2002-2006) for quarter 1, to assess whether or not the observed rate in 2007 was unusually high or low. Bycatch rates were calculated by applying the delta log-normal method using hooks as the unit of effort. The analytical methods were described in detail in Garrison (2003).

Results and Discussion

A total of 115 longline sets (~95,624 hooks) were observed during quarter 1 of 2007 (Table 1). The majority of the observed sets occurred in the Gulf of Mexico (GOM) fishing area (Figure 1).

There was one observed interaction with a leatherback turtle and 6 observed interactions with loggerhead turtles (Table 2*)*. The leatherback and five of the loggerhead turtles were released alive and injured, based on the observer's notes (Appendix A). One additional loggerhead was released alive, but the extent of the injury was unknown at the time of release. The locations of observed sets and turtle interactions are shown in Figure 1.

The quarterly and regional bycatch rates are summarized for marine turtles in Table 3. These rates were compared with those for marine turtles from the same quarter/area for 2006 and the average for the first quarter/area from 2002-2006 in Tables 4 (Fairfield and Garrison, 2006; Garrison, 2005). Specific information on injuries to sea turtles and gear characteristics of each interaction are shown in Appendix A.

For leatherback turtles, the bycatch rate in the Caribbean (CAR) was zero during this quarter, which was a reduction relative to the average 2002-2006 rates, and this area was not observed during the first quarter of 2006 (Table 4A). The bycatch rate in the Florida East Coast (FEC) was lower than that observed in 2006 as well as the average 2002-2006 rate for this area. The 95% confidence intervals for the rates from all three time periods overlapped (Table 4A). In the GOM, South Atlantic Bight (SAB) and Sargasso Sea (SAR) areas, the 2007 first quarter bycatch rates were zero, which was a reduction relative to the 2006 bycatch rate as well as the average 2002-2006 rate. In the Mid-Atlantic Bight (MAB) area, the 2007 first quarter bycatch rate was also zero, which was the same as the 2006

rate and was a reduction from the average 2002-2006 bycatch rate for this fishing area (Table 4A).

The average bycatch rate for loggerhead turtles caught in the CAR area was elevated relative to the average 2002-2006 rate for this area (Table 4B). The 95% confidence interval for this first quarter of 2007 was elevated relative to the 2002-2006 confidence intervals. The CAR was not observed during 2006. The bycatch rate in the FEC during the first quarter of 2007 was lower than that in 2006 and was lower than the 2002-2006 average. The confidence limits for all three periods overlapped (Table 4B). The bycatch rates for this first quarter of 2007 were zero for the GOM, MAB and SAR areas, which was similar to, or lower than, the rates for 2006 and for the average 2002-2006 rates. The first quarter 2007 bycatch rate for the SAB area was higher than the 2006 rate (which was zero) as well as the 2002-2006 average rate (Table 4B). The 95% confidence intervals for the 2007 bycatch rate overlapped with the 2002-2006 confidence intervals.

No marine mammals takes were observed during the first quarter of 2007 (Table 5). For pilot whales, this was a reduction in bycatch in comparison with the first quarter of 2006, and a reduction in the five year average, where bycatch was observed in the MAB area. For all other species, the lack of bycatch for the first quarter of 2007 was consistent with 2006 first quarter bycatch rates and was reduced from the average 2002-2006 rates.

Concerted efforts by fishers to remove hooks and disentangle captured turtles are mandated by the Biological Opinion. Only circle hooks (16/0 and 18/0) were observed during the first quarter of 2007. Seven hauls, however, were observed with 16/0 circle hooks with a 10 degree offset.

One leatherback, which was hooked externally, was observed taken in the FEC fishing area, and all gear was removed prior to release (Appendix A1). Six loggerhead turtles were captured during this first quarter of 2007, and all were released with all the hook and gear removed (Appendix A2). Three of these turtles were hooked in the mouth, one was hooked in the tongue, and one was hooked in the internal beak on the lower jaw. For one additional loggerhead, it was unknown if the animal was hooked upon capture, but this animal was released with no attached fishing gear.

There are a number of caveats and uncertainties associated with the current analysis. First, while these data have undergone an initial audit and review, they are subject to change upon further review after the end of the 2007 calendar year. Second, the delta log-normal estimator was applied to calculate bycatch rates consistent with previous estimates (e.g., Garrison 2003). This approach assumed 1) that catch rates (animals per hook) were log-normally distributed, and 2) that the number of hooks was an appropriate unit of effort. The first assumption has been evaluated for

turtles; however, violations of this assumption may have resulted in biased (positive or negative) estimates of catch rate and associated variances. The second assumption has not been examined critically in previous analyses. If this assumption was not correct, for example if there were saturation effects resulting in a non-linear relationship between the number of hooks and total catch, then there potentially may have been a bias in the estimate of bycatch rates.

The interaction between longline gear and protected species is a relatively rare event and is therefore inherently variable. Historically, there have been very large inter-annual fluctuations in bycatch rates and estimates of total bycatch. Thus, any differences observed between short term observations of bycatch rates and long term averages may be simply stochastic events and are not necessarily indicative of a significant change in the interactions between the longline fishery and protected species.

Literature Cited

Fairfield Walsh, C. and L.P. Garrison. 2006. Estimated Bycatch of Marine Mammals and Turtles in the U.S. Atlantic Pelagic Longline Fleet During 2005. NOAA Technical Memorandum NOAA NMFS-SEFSC-539: 51p.

Garrison, L.P. 2003. Estimated Bycatch of Marine Mammals and Turtles in the U.S. Atlantic Pelagic Longline Fleet During 2001-2002. NOAA Technical Memorandum NOAA FISHERIES-SEFSC-515: 52 p.

Garrison, L.P. 2005. Preliminary Estimates of Protected Species Bycatch Rates in the U.S. Atlantic Pelagic Longline Fishery Between 1 January and 31 March 2005. SEFSC Document #PRD-04/05-10: 14 p.

Table 1. The number of sets and hooks observed in the U.S. Atlantic Pelagic Longline Fishery between 1 January – 31 March 2007 is shown by fishing area. Areas with missing values indicate there was no observer coverage during this time period in this area.

Area	# Sets	# Hooks
CAR	3	2,132
FEC	20	18,261
GOM	58	49,104
MAB	10	5,960
NCA	-	-
NEC	-	-
NED	-	-
SAB	14	12,507
SAR	10	7,660
TUN	**-**	**-**
TUS	**-**	**-**
Total	**115**	**95,624**

Table 2. The total observed interactions with marine turtles in the U.S. Atlantic Pelagic Longline Fishery for sets beginning from 1 January – 31 March 2007 is shown by fishing area. All turtles were recorded as being released alive. Areas with missing values indicate there was no observer coverage during this time period in this area.

Area	Leatherback Takes Observed	Loggerhead Takes Observed
CAR	0	1
FEC	1	2
GOM	0	0
MAB	0	0
NCA	-	-
NEC	-	-
NED	-	-
SAB	0	3
SAR	0	0
TUN	-	-
TUS	-	-
Total	**1**	**6**

Table 3. The estimated bycatch rate (catch per 1000 hooks) is shown for (A) Leatherback and (B) Loggerhead turtles by area during 1 January – 31 March 2007 in the U.S. Atlantic Pelagic Longline Fishery. Missing values indicate areas with no observer coverage. CV indicates the coefficient of variation of the estimated rate. All turtles were recorded as being released alive.

A. Leatherback Turtles

Area	Type of Injury	Number of Turtles	Observed Sets	# Positive Sets	Mean CPUE	Var CPUE	CV
CAR	-	0	3	0	0	-	-
FEC	Alive	1	20	1	0.0521	0.0027	1
GOM	Alive	0	58	0	0	-	-
MAB	Alive	0	10	0	0	-	-
NCA	-	-	-	-	-	-	-
NEC	-	-	-	-	-	-	-
NED	-	-	-	-	-	-	-
SAB	Alive	0	14	0	0	-	-
SAR	Alive	0	10	0	0	-	-
TUN	-	-	-	-	-	-	-
TUS	-	-	-	-	-	-	-

Table 3 (cont.)

B. Loggerhead Turtles

Area	Type of Injury	Number of Turtles	Observed Sets	# Positive Sets	Mean CPUE	Var CPUE	CV
CAR	Alive	1	3	1	0.3949	0.1560	1
FEC	Alive	2	20	2	0.0833	0.0033	0.6883
GOM	-	0	58	0	0	-	-
MAB	-	0	10	0	0	-	-
NCA	-	-	-	-	-	-	-
NEC	-	-	-	-	-	-	-
NED	-	-	-	-	-	-	-
SAB	Alive	3	14	3	0.2252	0.0143	0.5312
SAR	-	0	10	-	0	-	-
TUN	-	-	-	-	-	-	-
TUS	-	-	-	-	-	-	-

Table 4. The bycatch rates are shown for (A) Leatherback turtles and (B) Loggerhead turtles in the U.S. Atlantic longline fishery during 1 January- 31 March 2007 in comparison to 2006 and the average rate from 2002-2006. 95% CI indicates the estimated 95% confidence interval of the mean bycatch rate (CPUE) in each cell assuming a lognormal distribution of rates. CPUEs reflect total turtles caught including alive and dead turtles.

A. Leatherback turtles

Area	2007 CPUE	2007 95% CI	2006 CPUE	2006 95% CI	2002-2006 CPUE	2002-2006 95% CI
CAR	0	-	-	-	0.0289	0.0059 – 0.1414
FEC	0.0521	0.0107 – 0.2546	0.1077	0.0220 – 0.5263	0.1991	0.1245 – 0.3185
GOM	0	-	0.0220	0.0045 – 0.1078	0.0989	0.0680 – 0.1440
MAB	0	-	0	-	0.0172	0.0035 – 0.0840
NCA	-	-	-	-	-	-
NEC	-	-	-	-	-	-
NED	-	-	-	-	-	-
SAB	0	-	0.3367	0.0989 – 1.1458	0.3541	0.1495 – 0.8390
SAR	0	-	0.0671	0.0137 – 0.3278	0.1117	0.0563 – 0.2217
TUN	-	-	-	-	-	-
TUS	-	-	-	-	-	-

Table 4 (cont.)

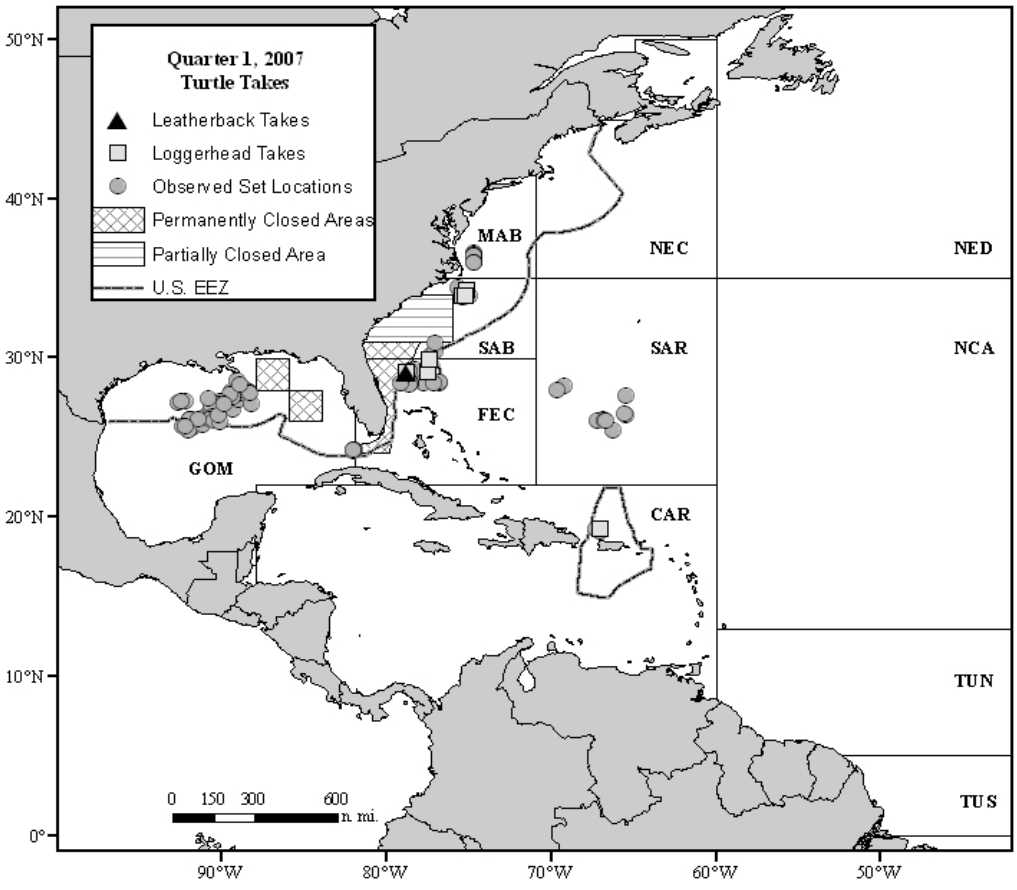
B. Loggerhead Turtles

Area	2007 CPUE	2007 95% CI	2006 CPUE	2006 95% CI	2002-2006 CPUE	2002-2006 95% CI
CAR	0.3949	0.0808 – 1.9306	-	-	0.2774	0.1631 – 0.4718
FEC	0.0833	0.0254 – 0.2731	0.1033	0.0211 – 0.5048	0.2487	0.1609 – 0.3844
GOM	0	-	0	-	0.0098	0.0035 – 0.0272
MAB	0	-	0	-	0.0657	0.0271 – 0.1595
NCA	-	-	-	-	0.1375	0.0460 – 0.4113
NEC	-	-	-	-	-	-
NED	-	-	-	-	-	-
SAB	0.2252	0.0871 – 0.5825	0	-	0.1476	0.0392 – 0.5563
SAR	0	-	0.1260	0.0386 – 0.4113	0.4519	0.2909 – 0.7018
TUN	-	-	0	-	-	-
TUS	-	-	-	-	-	-

Table 5. The summary of bycatch rates for marine mammals in the U.S. Atlantic longline fishery during 1 January – 31 March, 2007 is shown in comparison to rates from the previous year (2006) and the average of the previous five years (2002-2006). 95% CI indicates the estimated 95% confidence interval of the mean bycatch rate (CPUE) in each cell assuming a lognormal distribution of rates. CPUEs reflect total marine mammals caught including alive, dead, and seriously injured animals.

Species	Area	2007 CPUE	2007 95% CI	2006 CPUE	2006 95% CI	2002-2006 CPUE	2002-2006 95% CI
Beaked Whale	CAR	0	-	0	-	0.0423	0.0087 – 0.2069
Beaked Whale	SAR	0	-	0	-	0.0160	0.0033 – 0.0783
Bottlenose Dolphin	SAB	0	-	0	-	0.0309	0.0063 – 0.1512
Pilot Whale	CAR	0	-	0	-	0.0472	0.0142 – 0.1569
Pilot Whale	MAB	0	-	0.7418	0.3506 – 1.5694	0.2540	0.1202 – 0.5366
Risso's Dolphin	GOM	0	-	0	-	0.0044	0.0009 – 0.0215
Unid. Dolphin	GOM	0	-	0	-	0.0044	0.0009 – 0.0216

Figure 1. The observed U.S. Pelagic Longline Fishery effort and marine turtle interactions during 1 January – 31 March 2007 are shown. The pelagic longline fishing areas in the North Atlantic Ocean are as follows: CAR = Caribbean, GOM = Gulf of Mexico, FEC = Florida East Coast, SAB = South Atlantic Bight, SAR = Sargasso Sea, MAB = Mid-Atlantic Bight, NEC = Northeast Coastal, NED = Northeast Distant, NCA = North Central Atlantic, TUN = Tuna North and TUS = Tuna South. Closed fishing areas and the U.S. Exclusive Economic Zone (EEZ) are shown. The Partially Closed Area is closed between February 1 and April 30 each year.


Quarter 1, 2007
Turtle Takes
Leatherback Takes
Loggerhead Takes
Observed Set Locations
Permanently Closed Areas
Partially Closed Area
U.S. EEZ
MAB
NEC
NED
SAB
SAR
NCA
FEC
GOM
CAR
TUN
TUS
0 150 300 600
n. mi.
50°N
40°N
30°N
20°N
10°N
0°
90°W
80°W
70°W
60°W
50°W

Appendix A: Injury details and hook types for turtles captured in the U.S. Atlantic Pelagic Longline Fishery for sets during 1 January – 31 March 2007 are shown.

1. Leatherback Turtles

#	Area	Hook Type	Offset (degrees)	Bait	Bait Size (g)	Release Condition	Hook Location	Hook Removed?	Entangled Capture?	Entangled Release?	Line Left (ft)	CL Est. (ft)	CCL (cm)	Straight N-N (cm)
1	FEC	C-18/0	0	squid or mackerel	189 or 378	Alive, injured	armpit	Yes	No	No	0.00	5.00		

2. Loggerhead Turtles

#	Area	Hook Type	Offset (degrees)	Bait	Bait Size (g)	Release Condition	Hook Location	Hook Removed?	Entangled Capture?	Entangled Release?	Line Left (ft)	CL Est. (ft)	CCL (cm)	Straight N-N (cm)
1	CAR	C-18/0	10	squid	269	Alive, injured	mouth, lower jaw, other	Yes	No	No	0.00		79	71.8
2	FEC	C-18/0	10	mackerel	450	Alive, unknown	not know if hooked	Yes	No	No	0.00	2.30		
3	FEC	C-18/0	10	squid	248	Alive, injured	mouth, side, other	Yes	No	No	0.00		74	66.7

4	SA B	C-18 /0	10	squid	206	Alive, injured	mouth, lower jaw, other	Yes	No	No	0.00		60.1	52.8
5	SA B	C-18 /0	10	squid or macker el	196 or 227	Alive, injured	tongue	Yes	No	No	0.00		70.4	64.1
6	SA B	C-16/0	10	squid or macker el	197 or 227	Alive, injured	beak internal, lower jaw	Yes	No	No	0.00		73.1	65.3